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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

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| In re patent application of: | ) Art Unit: 2181 |
| David A. Goldman | ) Examiners: Tim T. Vo<br>) Robert Beausoleil |
| Serial No.: 09/134,981 | ) Date: August 15, 2001 |
| Filed: August 17, 1998 | ) Atty. Docket No.: H-409 |
| For: AUTOMATICALLY GENERATING EMBROIDERY DESIGNS FROM A SCANNED IMAGE | ) |



APPEAL BRIEF

Honorable Commissioner of Patents and Trademarks

Washington, DC 20231

S I R:

This appeal is responsive to the Final Rejection of March 16, 2001 (Paper No. 7), and the Office Advisory Action of May 23, 2001 (Paper No. 9).

The Commissioner is hereby authorized to charge any fees in connection with this appeal or with other matters before the PTO to the undersigned's Deposit Account No. 19-0077.

## REAL PARTY IN INTEREST

The real party in interest hereto is Appellant's assignee. The interest in the invention was assigned by the inventor to Soft Sight, Inc. at the time of filing the application, and was recorded on Reel No. 9464, Frame No. 0401.



## RELATED APPEALS AND INTERFERENCES

This appeal is the first appeal before the Office.

## STATUS OF THE CLAIMS

Claims 1 through 9, 11 through 14, 16 through 18, and 20 now stand FINALLY REJECTED. Claims 15 and 19 are indicated allowable, but presently dependent upon rejected claims. The FINAL REJECTION (Paper No. 7), and the Advisory Action of (Paper No. 9) are in error as to the status of the claims. Claim 10 was canceled in the amendment filed January 4, 2001. With all due respect, the Office has not acknowledged this cancellation.

The rejection of claims 1 through 9, 11 through 14, 16 through 18, and 20 is hereby appealed.

## STATUS OF THE AMENDMENTS

The application was filed on August 17, 1998. An Office Action was mailed on October 3, 2000 (Paper No. 5). An amendment was filed on January 2, 2001 (Paper No. 6) in response. The FINAL REJECTION was mailed on March 16, 2001 (Paper No. 7). An Office Interview was held on May 15, 2001 among Appellant's attorney, Mark Levy, the inventor, Dr. David Goldman, and Examiner Tim Vo. An amendment after FINAL REJECTION was HAND CARRIED to Examiner Tim Vo, and presented to him at the Office Interview.

An Office Advisory Action, apparently erroneously citing a non-analogous patent with which Applicant was heretofore unfamiliar, was mailed on May 23, 2001, but was not received by Appellant's attorneys. Examiner Tim Vo was consulted, and kindly faxed a copy of this action to Robert Salzman, one of the attorneys of record on or about August 6, 2001.

## SUMMARY OF THE INVENTION

The invention comprises a method and system for computerized embroidery of scanned color images. Generally, the present invention supplies a file containing embroidery data (from a scanned color image) to an embroidery-generating program. In turn, the embroidery-generating program executes a series of sub-routines with respect to the embroidery data file, and produces an embroidery output file, which contains data that is fed to a sewing device for stitching the embroidery design.

The embroidery-generating program of this invention has many complex features, owing to the fact that a scanned color image that is to be converted into an embroidery pattern must account for many subtle distinctions: color shading, line thickness, and other subtle characteristics that the eye can perceive, but which are often irreproducible by the common computer program, particularly those processing only black and white data.

The sub-routines, which are the heart of the current invention, contain a segmentation mechanism, a chain-coding mechanism, a distance transform computation mechanism, a line-fitting mechanism, a stitch angle determination mechanism, a

fragment generating mechanism, an embroidery output mechanism, a fitting mechanism, a labeling mechanism, a merging mechanism, a coding mechanism, a column smoothing mechanism, and a path generating mechanism.

When a user first scans a color embroidery pattern, the software program within the scanner creates a representation of the pattern, referred to as embroidery data. The embroidery data is broken up into small objects called pixels. Each pixel in the embroidery data has a bitmap associated with the color of the pattern. Each unique color in the scanned pattern has its own unique bitmap. Before the embroidery generating mechanism executes the embroidery data, embroidery data is in its raw form, and the bitmapped data stored within the file has not yet been preprocessed. For example, some pixels may have incorrect bitmap assignments due to scanner noise or other subtle variations in color, such variations being accounted for by the human eye but their distinction becoming non-trivial when dealt with procedurally by a computer program.

Once embroidery data has been scanned, the embroidery generating mechanism executes a segmentation routine that classifies each pixel within embroidery data into a distinct object. Each object represents a general color in the data.

Any pixels that were not categorized into a particular object during the first segmentation may be considered noise, generated during scanning, when the scanner could not properly assign a bitmap for a particular pixel, as would be likely achieved by a human counterpart.

Each pixel has a series of eight neighboring pixels. It is likely that at least one of these neighboring pixels has been assigned to a particular object. The segmentation sub-routine assigns an uncategorized pixel to an object, where a neighboring pixel has been assigned. It should be understood that one or more of the eight neighboring pixels might belong to different objects. The segmentation mechanism uses mathematical methods to determine to which object an uncategorized pixel should be assigned. This is where black and white, versus color processing, is most different, because not limiting a system to only two values (black and white) introduces substantial complexity to the automated embroidery problem as it relates to image segmentation.

Once the segmentation sub-routine segments embroidery data into objects, the chain-coding sub-routine performs further image processing on each individual object within the embroidery data. The chain-coding sub-routine codes each object's edge contours, and then uses the contours to compute

the skeleton and integer distance transform, DT, for each object.

The system classifies each object into one of two categories. Either the object is a thick, predominantly singular object, or a thin, predominantly regular object. Whether the object is classified as a thick or a thin object determines the next series of processing steps needed to generate output embroidery data for each object.

The system will then execute different processing routines depending on the shape characterization. Several processing routines embody the notion of labelling or identifying unique points on the skeleton and edge contours of a shape. Furthermore, these separate skeletal and edge contour points are interrelated: a particular point on an edge contour may be deemed to belong to a particular point on a related skeletal contour, like a jigsaw puzzle piece belongs to a particular location within the puzzle scene. The use of interrelating skeletal points with edge contour points forms one of the primary foundations of the invention. It is these interrelations that allow singular and regular regions to be identified within shapes and that allow subsequent embroidery to be generated.

## ISSUES

All of the claims of the application, but for claims 15 and 19, have been rejected as being anticipated by FUTAMURA (United States Patent No. 5,740,056) under 35 U.S.C. §102(e).

## GROUPING OF THE CLAIMS

The claims should not be grouped together, because many of the dependent claims contain processing features not contained in the independent claims. Some of these processing features are unique to color stitching, and are respectfully not shown or suggested by the black and white embroidery program illustrated by the cited art of record. Furthermore, with all due respect, the Office has failed to rebut Applicant's arguments in many respects regarding both independent and dependent claim features and differences, either appearing to ignore, gloss-over, or misinterpret salient arguments and claim language presented by Appellant. Fairness and completeness should dictate a careful reading of all of the claimed features represented by Applicant's independent and dependent claims.

Appellant's attorneys respectfully suggest a grouping of

claims 1 through 11, excluding cancelled claim 10; claims 12 through 14 and 16 through 18; and claim 20. Independent claim 1 calls for interrelating skeletal and edge contours, which clearly relate to the processing of an image as taught by Appellant. Independent claim 12 recites "classifying and line-fitting" with respect to both edge and skeletal contours for thin objects or thick objects. Independent claim 20 recites locating and interpreting a set of regular and singular regions, and computing an optimum sew order, as befits embroidery. These independent claims should not be lumped together, because they deal with different aspects of Appellant's method.

## ARGUMENT

The Honorable Board is respectfully requested to consider that in order for an application to be considered anticipated by the cited art under 35 U.S.C. §102(e), there must be present a complete teaching of all of the salient features of Appellant's claimed process. Appellant, through his attorneys, contends that the FUTAMURA reference does not present so fine and complete a teaching in accordance with section 102 of title 35, that "anticipation" is proven in accordance with the statute.

Appellant has made the following arguments, to which the FINAL REJECTION was respectfully in error.

Appellant has generated a program that is bifurcated with respect to processing black and white images, and color images. Appellant noted from the beginning that FUTAMURA processed only black and white embroidery. The Office maintained that black and white where colors indicative of meeting the claim language of claims 1, 12, and 20. This is respectfully a specious argument built upon semantics. "White" does represent a color, but "black" is defined as a shade. However, Appellant does not desire to rely on semantics, but rather wishes to suggest to the Honorable Board that the claims be interpreted with respect to the teachings in the specification, in which different processing is shown for embroidery in color (i.e., colors of the spectrum) vis-à-vis black and white. Please see In Re Buehler, (CCPA 1975) 515 F2d 1134, 185 USPQ 781. It is not proper for the Office to suggest that FUTAMURA meets the claim language of "color" by showing black and white. Appellant's specification must be used to interpret the claims, and Appellant's specification defines color as "colors of the spectrum". Also, please see In re Boe et al, (CCPA 1974) 505 F2d 1217, 184 USPQ 38. "Limitations in claims distinguishing over the prior art cannot be ignored." In processing color, different problems

present themselves to Appellant that are not addressed by FUTAMURA. These problems include factors relating to image segmentation, a concept not mentioned in FUTAMURA.

Moreover, FUTAMURA is silent with respect to shape characteristics, such as: intersecting of multiple pattern lines (i.e., singular regions), irregular, and non-uniform boundaries, fill stitching, etc. Independent claim 1 calls for creating and interrelating skeletal and edge contours, which clearly relate to processing a color, scanned image as taught by Appellant. The Office neglected to address this issue entirely, notwithstanding the fact that it forms a crux of the invention and is clearly not anticipated by FUTAMURA. The claims were amended (see claim 1(c)) and appropriately argued, but were never acknowledged by the Office.

Independent claim 12 recites "classifying and line-fitting" with respect to both edge and skeletal contours for thin or thick objects. Again, FUTAMURA does not anticipate such a combination of classifying and line-fitting with the use of edge and skeletal contours.

Independent claim 20 recites locating and interpreting a set of regular and singular regions, and computing an optimum sew order, as befits embroidery. FUTAMURA neither identifies

nor processes regular and singular regions.

Comparing the two flow diagrams of each invention, it clearly becomes evident that Appellant's method is much more complex than FUTAMURA. How FUTAMURA can be equated as anticipatory of Appellant's method, respectfully defies logic.

Claim 2 teaches the sub-routine process of segmenting, which characterizes each pixel of an image data file as an object. In color, scanned data requires image segmentation. Appellant had submitted Exhibits A and B to illustrate the point that no segmentation was performed by FUTAMURA. In FUTAMURA, such data was utilized directly, potentially resulting in erroneous outcomes, as indicated in Exhibit A. Data in FUTAMURA was processed irrespective of pixels representing noise, half tones, and other anomalies. In claim 2, paragraph (c), Applicant recites means for locating and interpreting a set of regular and singular regions for embroidery point generation, which is not shown in column 5, lines 19 through 24 of FUTAMURA, as the Office contends. The description in column 5, lines 19 through 24 of FUTAMURA refers to scanning the image and storing it in RAM. The Office has respectfully twisted Appellant's wording in the claim, so that FUTAMURA can be read into Appellant's invention. In claim 2, paragraph (d), neither is the "path

generation" nor the "optimum sew order" for at least one extracted column, shown in column 5, lines 51 through 67, as the Office contends.

Most importantly, there is no path planning in FUTAMURA. This is a very important processing step for Appellant.

Appellant can go on distinguishing the differences, but it would be gilding the lily. It should be obvious at this point that FUTAMURA cannot meet the burden of "anticipation," in accordance with 35 U.S.C. §102.

Considering claims 3 and 18, FUTAMURA does not teach line-fitting in combination with both edge and skeletal contours, in the sense taught by Appellant.

Considering claims 4, 5, 13 and 14, please observe that FUTAMURA does not teach stitch angle determination, which is part of fragment ordering, that is important in generating fill stitch objects. In fact, FUTAMURA does not generate objects of this type by any method.

Considering claim 6, FUTAMURA does not teach labelling a plurality of points individually belonging to a shape's skeleton and edge contours.

Considering claim 7, FUTAMURA does not teach "merging a series of points on the skeleton contour."

Considering claim 8, FUTAMURA does teach "coding means for evaluating a plurality of singular regions."

Considering claim 9, FUTAMURA does not teach "smoothing means for evaluating a sequence of stroke normals."

Claim 11 recites selecting a uniform color selected from a group of colors in the continuous spectrum. FUTAMURA, who processes only black and white, is definitely non-anticipatory.

In Paper No. 7, page 2, the Office states that the recitation: "fill stitch, and handling cases where multiple pattern lines intersect (i.e., singular regions within the pattern)," was not found in Appellant's claims, as a means of blunting Appellant's claimed differences over the cited FUTAMURA. Claims 8 and 20, while not reciting the exact wording, do speak of interpreting and generating an output file dependent on a set of regular and singular regions. What the Office neglects is that FUTAMURA does not teach a method that even considers the claimed coding of regular and singular regions, and therefore certainly cannot be considered

anticipatory.

Finally, the reference by the Office pursuant to the Advisory Action of May 23, 2001 (U.S. Patent No. 5,444,640) appears to be an error on the part of the Office, as it relates to a numerical control method correcting for thermal displacement, which obviously has nothing to do with embroidery.

In summary, the Office suggests that many of the claimed differences suggested by Appellant are not in the claims, and cannot be read into the claims by way of specification teachings. But Appellant's claims do recite differences sufficient for their being allowable. Detail, when required, is generally left to the specification. Appellant argues that having made recitation of a defining difference, the specification can be used to fill in any interpretive meaning.

## CONCLUSION

The Honorable Board is respectfully requested to reverse the rejection of claims 1 through 9, 11 through 14, 16 through 18 and 20, and allow the subject application to issue as a patent.

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on 8/15/01
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APPENDIX

1. A system for automatically producing an embroidery design, the system comprising:

a) means for inputting an embroidery pattern into an image data file, the image data file comprising a plurality of pixels, each pixel comprising a bitmap representing a color;

b) processing means operatively connected to said inputting means for creating skeletal and edge contour data and storing said image data file; and

c) an embroidery data generating mechanism operatively connected to said processing means for labeling and interrelating said skeletal and edge contour data and generating a complex embroidery pattern directly from a scanned, color image.

2. The system of claim 1, wherein said embroidery data generating mechanism comprises:

i) segmenting means for characterizing each pixel within the image data file into an

object;

ii) means for classifying each of said objects as a thin object or a thick object;

iii) means for locating and interpreting a set of regular and singular regions for embroidery data point generation.

iv) path generation means for computing an optimum sew order for at least one extracted column; and

v) embroidery output means for generating an embroidery output file.

3. The system of claim 1, further comprising line-fitting means for line-fitting each object, wherein an object comprises an outer contour, a predetermined number of inner contours, and a skeleton contour, said line-fitting means comprising a gallus-neurath triangular filter.

4. The system of claim 3, further comprising stitch angle determination means for determining a stitch angle

that produces a minimal plurality of fragments.

5. The system of claim 4, further comprising generate path means for determining an optimal order for the plurality of fragments to be sewn.

6. The system of claim 1, further comprising labelling means for labelling a plurality of points on the skeleton and edge contours.

7. The system of claim 6, further comprising merging means for merging a series of points from the plurality of points on the skeleton contour.

8. The system of claim 7, further comprising coding means for evaluating a plurality of singular regions.

9. The system of claim 8, further comprising smoothing means for evaluating a sequence of stroke normals.

11. The system of claim 1, wherein said object comprises a plurality of connected or contiguous pixels having a uniform color.

12. A method for automatically producing an embroidery design, the method comprising the steps of:

a) inputting an embroidery pattern into an image data file, the image data file comprising a plurality of pixels, each pixel comprising a bitmap representing a color;

b) classifying and line-fitting each object in said bitmap as a thin object or a thick object, each of said objects comprising an outer contour, any number of inner contours, and a skeleton contour;

c) computing an optimum sew order; and

d) generating an image output file.

13. The method of claim 12 further comprising the step of generating the plurality of fragments.

14. The method of claim 13 further comprising the step of determining an optimal order for the plurality of fragments to be sewn.

16. The method of claim 15 further comprising the step of extracting at least one column.

17. The method of claim 16 wherein said step (b) of classifying each pixel within the image data file comprises the step of associating each connected pixel having a similar color with a unique object identity.

18. The method of claim 17 wherein said step (b) of classifying additionally comprises the step of traversing a plurality of chain codes associated with one of the group of skeleton contour, inner contour(s), and outer contour.

20. A method for automatically producing an embroidery design, the method comprising the steps of:

a) inputting an embroidery pattern into an image data file, the image data file comprising a plurality of pixels, each pixel comprising a bitmap representing a color;

b) locating a set of regular and singular regions disposed in said image data file;

c) interpreting said set of regular and singular regions;

d) computing an optimum sew order; and

e) generating an image output file dependent on said interpreted set of regular and singular regions.

END OF APPENDIX